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ABSTRACT

Computing literacy programs at Iona College are discussed, including developments since 1979. Information is provided on the college's computing facilities, software resources, competencies defined before and after 1980, and program funding. Additionally, a computer literacy program for administrators is considered in detail. The following concerns regarding the program for administrators are covered: the content and structure, study units, applications systems that were used, components that were evaluated, factors that influenced participation in the program, the background of participants, hardware and software that were used, and a followup study of behavioral change in participants. Additionally, attention is directed to a proposed strategy for promoting computing literacy, refining the definition of computing literacy, and revising the syllabus for administrators. Conclusions include the following: administrators are interested in a computing literacy program; a marked attitudinal change among the administrator participants has occurred whereby they are integrating computing into their daily professional activities; and the majority of administrators are still in the early stages of computer literacy and are not yet ready to make computing part of their basic mode of operating. (SW)

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COMPUTING LITERACY FOR EDUCATIONAL ADMINISTRATORS

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Within the last five years, the development of computing literacy for faculty and students has been one of the more urgent concerns within educational institutions. Although there is no single definition of "computing literacy", many groups have developed a working definition of the term so that programs of computing literacy could be developed and implemented. The interest in computing literacy can be measured in several ways: by the number of schools with programs in this area; by the number of schools requiring some coursework in computing; and by the number of schools requiring that students acquire and/or have access to a "personal" microcomputer.

Computing may be used in any or all of the following areas within an educational institution: instruction; research; educational administration. The first two areas involve faculty, students, and researchers. The latter involves the educational administrator. While all three user groups are, or will be, involved in integrating computing into their daily professional lives, the existing computing literacy programs have been directed primarily to faculty and students. The educational administrator is often the "forgotten man" in computing literacy programs.

Iona College has been actively developing a program of computing literacy over the last four years. Beginning with the 1983-84 academic year, all students must satisfy a computing literacy requirement as part of the core curriculum. In order to implement such a program, much work was done to develop a computing literacy definition and curriculum. Faculty development has been underway so that faculty outside the field of computer science may begin to understand how computing relates to their discipline and how it may be integrated into their coursework.

Computing literacy for educational administrators is the most recently addressed component of the computing literacy program. This paper will define this new area of computer literacy and discuss the experiences gained over the past year in testing the curriculum and the delivery mechanism. The results of this effort (both the successes and the concerns) will be described as well as future directions for the program.

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COMPUTING LITERACY FOR EDUCATIONAL ADMINISTRATORS

Introduction

Iona College is a medium-size liberal arts institution located in New Rochelle, New York. The College educates more than 6,000 students annually in degree programs at the undergraduate and graduate levels. Many of its students are first generation college students who wish to combine higher education and career preparation. Understanding these needs, Iona has traditionally attempted to blend a liberal arts education with the ability to find professional positions upon graduation.

Iona College has made a commitment to computing that is consonent with its liberal arts philosophy. It provides all students with a fundamental understanding of computing. It provides students seeking a computer and information science specialization with a variety of degree programs.

Computing Curricula

The College currently offers five undergraduate and five graduate degree programs in computer and information science.

- B.S. degree
  - Computer Science
  - Decision Science
  - Computer Engineering
  - Data Processing
- B.A. degree
  - Computer Information Science
- M.S. degree
  - Computer Science
  - Educational Computing
  - Mathematics and Computers
- M.B.A. degree
  - Management Information Systems
  - Management Systems and Science

Computing Literacy at Iona College: A Historical Perspective

By 1979, the growing importance of technology convinced the College that computing should play a major part in its curriculum. In 1979, computing was an option within the science area of the core curriculum. Arts and Science students could study computer science as an elective. Business students were required to complete six credits in computer science as part of the Business core.

The Science and Technology Project, begun in 1979, studied alternatives for implementing computing as a requirement for all undergraduate students. This project led to the implementation of the computer literacy requirement in 1983.

The following are some of the more significant activities during the period from 1979-1983:

1979 - Establishment of a Science and Technology Committee to study alternatives for implementing computing and science technology as part of the core curriculum.
1980 - "Computer Literacy: A Report to the Science Development Committee".
1981-82 - Pilot test of a computing literacy curriculum.
1981 - Establishment of a computing literacy program for faculty.
1982 - Establishment of a computing literacy program for administrators
1983 - Computing literacy requirement as part of the undergraduate core curriculum.

Computing Facilities

The College has a well-established and highly-developed central computing facility to support the administrative and academic users. The central facilities have been the primary delivery mechanism for providing end user computing until 1982. Formal microcomputer facilities were introduced in 1982 and substantially expanded in 1983.

The academic users have access to an IBM 4341 Group II system. There are 150 terminals available in student laboratories. The academic users are supported by the MUSIC (McGill University System for Interactive Computing) and VM/CMS operating systems. The majority of the academic systems run under MUSIC.

An IBM 370/135 with 48 terminals supports the administrative systems and users. The 370/135 will be replaced by an IBM 4341 system in December 1983; an IBM 43x1 is scheduled for installation in 1984.

There are 125 IBM Personal Computers in student laboratories and departmental and administrative offices. There are an additional 75 microcomputers (APPLEs, PETs, Tektronix, etc.) throughout the campus.

Software Resources

The extensive computing facilities (both mainframe and microcomputer) permit the Computing Center to provide its users with a wide range of application systems and programming languages.

Some of the more heavily used application systems available to users are:

- Word/text processing: MUSIC/SCRIPT; EasyWriter; WordStar
- Electronic worksheets: VisiCalc; 1-2-3; Iona AESOP (Advanced Electronic Spreadsheet Oriented Package)
- Database systems: dBASE II; Iona DATABASE
- Data Analysis: SPSS; MUSIC STATPAK

Some of the more heavily used programming languages are: PL/I (and PL/C); BASIC; COBOL (and WATBOL); FORTRAN (and WATFIV); PASCAL; Assembler Language.

Computing Literacy: A Pre-1980 Definition

One of the tasks of the 1979 Computing Literacy Project was to develop a definition of computing literacy that would promote an understanding of computers and their uses. The approach taken was to express literacy in terms of general competencies as well as specific computer skills. Since the program was being developed primarily for individuals outside of computing, it was more helpful to define literacy as a series of universal and subject-specific competencies which could be mapped to more specific computing objectives.

The universal competencies identified were:

- Knowledge of the history and uses of computing
- Knowledge of the types of problems amenable to computer solution
- Knowledge of the types of problems not currently amenable to computer solution
- The ability to read/write introductory computer programs
- Knowledge of the moral or human-impact issues relating to the societal use of computers

In addition, the following subject-specific competencies were identified:

- The ability to use and evaluate the computer as a problem-solving tool for discipline- or level-specific tasks
- Experience in using games and simulations for broader learning.

The Computing Literacy Project focused on defining computing literacy and formulating an implementation plan. Although the first phase was to implement a literacy program for the students, the objective was to produce a definition of computing literacy that would be valid across the academic community (faculty, students, administrators, staff).

Given the wide variety of user backgrounds and interests, defining computer literacy as a series of levels appeared to have merit. Computing literacy was defined in terms of a "minimum competency" which could be attained at Level 4. It was anticipated that, with a series of increasing skill levels, users would progress to the level that would best

meet their needs to use computing on an on-going basis.

The "Computer Literacy Report" identified seven literacy levels:

- Level 1
  - Establish and terminate communications with a computing system
  - Intitiate execution of some action causing computer to perform a task
- Level 2
  - Use programs and/or systems that require decision-making during execution
- Level 3
  - Understand the use of computers in modern society
  - Knowledge of function and uses of computer
  - Understand where and how to apply computing to situations
  - Understand societal and technological impact of computing
- Level 4
  - Use computing to solve a problem in one's own field
  - Write introductory programs for problem solving
- Level 5
  - Develop programs in standard high-level programming languages
- Levels 6-7
  - Perform as a computing professional

Computing Literacy: A Definition for the 1980s

The two year pilot test of the computing literacy curriculum revealed the following limitations in the original definition:

- Some levels were too narrow to warrant individual treatment
- Some levels were too broad and must be subdivided
- Some levels should be re-arranged to correspond to the natural progression of the users' skills
- Some issues were not addressed by any of the levels
- Problem solving techniques should be emphasized in conjunction with hands-on experience
- Application systems should be emphasized for users outside of computing
- Programming should not be emphasized for users outside of computing

The identification of the levels and their contents were modified in 1983 to address the above concerns. In the revised structure, "minimum competency" is reached at Level 5. The revised level structure is currently being pilot tested.

- Level 1
  - Understand the use of computers in modern society
  - Understand societal, ethical and technological impact of computing
- Level 2
  - Level 1 literacy
    and
  - Knowledge of function and uses of computer
  - Understand where to apply computing to situations
  - Understand how to apply computing to situations
- Level 3
  - Level 2 literacy
    and
  - Understand the role of data within application systems
  - Understand the relationships that data has to each other and to the application systems
  - Understand the importance of valid data
  - Understand the consequences of invalid data
  - Understand the value of data within information systems
  - Understand the costs (gathering, entering, and storing) of data within information systems
- Level 4
  - Level 3 literacy
    and
  - Establish and terminate communications with a computing system
  - Intitiate execution of some action causing computer to perform a task
  - Use programs and/or systems that require decision-making during execution
- Level 5
  - Level 4 literacy
    and
  - Use computing to solve a problem in one's own field
  - Use application systems for problem solving
- Level 6
  - Level 5 literacy
    and
  - Read/write introductory programs in a standard high-level programming language
- Level 7
  - Level 6 literacy
    and
  - Solve a problem in one's own field by writing an application program in a standard high-level programming language
- Levels 8-9
  - Level 7 literacy
    and
  - Perform as a computing professional

Implementing a Computer Literacy Program for Administators

By 1982, computing literacy programs were in place for students and faculty. Students could enroll in computing literacy courses. Faculty could attend literacy seminars designed assist them in integrating computing into existing, non-computing curricula. The next phase was to expand this program to address the administrators' needs.

To implement and administer a computer literacy program for administrators, the Computing Center:

- Expanded its existing computing literacy program
- Developed the teacher and student instructional materials
- Promoted and publicized the program
- Taught the seminars
- Evaluated the curriculum and the program format

Funding Computing Literacy Programs

The Computing Center viewed the literacy program as a service it offered to the College community. The seminars were free of charge to College personnel. The costs of developing and offering the seminars and creating and publishing the instructional materials were fully underwritten from the Computing Center's operating budget.

The College administration supported the computing literacy programs through grants to faculty and administrators. These grants provided support by subsidizing individuals interested in acquiring personal computers and for professional development grants to pursue additional studies in educational applications and/or research.

Content and Structure of a Literacy Program for Administrators

In 1982, the Computing Center developed a program for educational administrators on how computers could be used as a problem-solving tool in an educational institution. The seminars focused on introductory computer concepts and problem solving through the use of applications systems rather than computer programming. Case studies were used to illustrate the application of these systems to educational institutions. No previous experience in computing was assumed.

The seminar format combined both lecture and "hands-on" learning activities in an attempt to provide the participants with actual experiences in using the application systems. To support this format, the program was conducted in the Computing Center Training Facility. The Training Facility was equipped with user workstations and a large-screen projection system. The latter allowed the teacher to demonstrate the concepts being taught.

Registration was limited so that there was no more than a 2-1 ratio of registrants to equipment. Wherever possible, there was a 1-1 ratio of registrants to equipment.

Applications systems for mainframe and microcomputers were taught in the seminar series. Registrants were given "hands-on" experiences using mainframe terminals and IBM Personal Computers. The choice of equipment was influenced by the applications system being taught.

The computing literacy curriculum consisted of a series of units. The syllabus and time allocations by unit follows:

- Computing applications in educational institutions (2 hours)
- Introduction to computing concepts (2 hours)
- Using applications systems for problem solving (3 hours)
- Word processing for report writing (4 hours)
- Electronic worksheets for modeling, planning and decision making (8 hours)
- Building information systems with a database system (3 hours)
- Analysis of data and presentation of summary statistics (3 hours)
- Presentation of data in graphics format (1 hour)
- An overview to integrated information processing (1 hour)

Some of the application systems used in the program were:

- MUSIC (McGill University System for Interactive Computing)
- MUSIC/MEMO (electronic mail)
- MUSIC/SCRIPT (word processing)
- VisiCalc (electronic spreadsheets)
- dBASE II (database systems)
- SPSS (data analysis)
- IBM GDDM and ICU (business graphics)
- LOTUS 1-2-3 (integrated information processing)

The administrators' literacy program was offered twice during the 1982-83 academic year. Two different formats were used to determine the one best suited to the administrator's schedules. The first time the program was presented as a four-day program. In the second offering, the material was divided into independent modules, presented in blocks of 2-3 hours, over the course of a semester.

Evaluation of Literacy Program

The year's experiences were helpful in determining the effectiveness of the program. Some of the areas reviewed were:

- Factors influencing administrator participation in the program
- Background of the administrator
- Contents of the program
- Structure of the program
- Resources (hardware, software, personnel, facilities) required to support the program
- Behavioral changes in the participants

Factors Influencing Participation in the Program:

A questionnaire was sent to the administrators participating in the program to learn which factors influenced their participation in the seminars. The survey indicated the following reasons:

- Lack of technical knowledge (87%)
- Curiosity about computers (53%)
- No cost for seminars (53%)
- Need to know the information (40%)

Background of the Participants:

The authors have proposed the following as a profile of an educational administrator seeking computing literacy:

- Highly motivated
- "Computer-phobic" to varying degrees
- Concerned about failure to master computing
- Under pressure from presence of colleagues
- Disadvantaged because of weak keyboarding/typing skills
- Unprepared for the amount of time required to become a proficient user
- Limited in time availability

Contents of the Program:

The modules on the use of application systems were the most popular with the registrants. Beginning users were not interested in the more abstract topics. There was usually considerable interest in expanding the introductory discussions of some application systems into fuller modules.

Structure of the Program:

The program evaluation indicated that the users preferred the series of independent modules to the intensive all-day format. It was better suited to their calendars and time commitments. The distribution of the material over the semester also allowed more time for the mastery of the material.

The faculty teaching the seminars have reported that there is a need to adjust the time allocated to the various topics. Some topics do not generate sufficient interest; it is recommended that some of these topics be removed from the syllabus. There are some topics which generate a great deal of interest and it has been recommended that these topics be expanded.

The faculty has also recommended that the format of the program be modified to agree with the learning styles and rates of learning by the participants. The combination of lecture and hands-on exercises was effective in starting the learning process, but not sufficient in itself to sustain and complete it. After a period of time, much of the knowledge was lost unless it had been applied. Users trying to apply the systems after a period of inactivity needed technical support to regain a level of useful productivity.

Hardware and Software Used in the Program

The time required to achieve self-sufficiency in using an application system seemed to be affected by the hardware on which the system was used. Beginning users found using the microcomputers to be more complex than using terminals by a factor of 2-1 or 3-1. As a result, terminal users were self-sufficient more quickly than microcomputer users.

The users also responded more favorably to systems which were interactive, user-friendly, and non-technical in its interaction with the users. They learned more rapidly when an on-line help facility was available.

Computing Literacy and Behavioral Change:

Six months after the program was offered, the participants received a questionnaire which attempted to measure behavioral change in the participants. It surveyed them regarding the seminars they had attended, the systems they were currently using, and future seminars they would be interested in attending. The results of the survey indicated that:

- A small percentage of registrants were using the systems they had studied. Usage statistics were higher for the introductory applications:
  - Word processing (50%)
  - Electronic mail (33%)
- There was interest in attending additional seminars.
  - Introduction to microcomputer applications (26%)
  - VisiCalc (26%)
  - Word processing (20%)
  - SPSS and data analysis (14%)

A Proposed Strategy for Promoting Computing Literacy

To support future computing literacy activities, the Computing Center is:

- Refining the definition of computing literacy and the levels
- Redesigning the structure and format of a literacy program
- Developing techniques for the reinforcement of learning and literacy activities
- Instituting a different policy for funding a computing literacy program

Refining the Definition of Computing Literacy:

It is important to distinguish between computing awareness and computing literacy. Computing awareness encompasses the lower levels of the skills hierarchy (Levels 1-3). It focuses on awareness of the roles that computing plays in the individual's daily life and in society. Computing literacy refers to that skill level at which the individual has some mastery of the hardware and software and is a regular user of computing. Using this distinction in the current environment, computing literacy would not be reached before Level 5. However, the dynamic nature of computing technology makes continued evaluation and refinement of any definition of either computer awareness or computer literacy an on-going activity in a computer literacy program.

Structure and Format of the Program:

The authors are in the process of revising the syllabus for the seminars. Some of the more abstract topics will be moved to the end of the syllabus or removed from the program. The time allotted for certain systems is being expanded. More laboratory sessions are being scheduled. The overall effect is to increase the length of the program. It must be determined if the administrators' schedules can accommodate a longer educational program.

Because of the experiences in the program, the authors are proposing that a format similar to the NSF Chattauqua seminars be adopted. Under this structure, the seminars would be split into two portions. The interval between segments would be long enough to permit the registrants to complete an application of interest to them. Reports on user projects would become part of the seminar.

The authors are also considering offering the seminars off-campus. Removing the participants from the interruptions of daily campus activities might reduce the number of individuals who do not complete the program because of interrupted education.

Funding a Computing Literacy Program

The authors feel that the current "no charge" policy is not cost effective. They have recommended that a fee structure be associated with the seminars. The fee could be covered by an administrative mechanism such as a departmental charge-back system. In addition, professional development grants could be used to cover the cost of the internal education.

Summary

The experiences have shown that administrators are interested in a computing literacy program. This project has provided the authors with greater insights into designing a curriculum and a delivery mechanism for a computer literacy program for this audience.

There has been a marked attitudinal change among the administrators. They are more receptive to the integration of computing into their daily professional activities. However, it would appear that the majority of the users are still in the early stages of computer literacy and are not ready to make computing part of their basic mode of operating.

The validity of computing literacy as an institutional goal appears to have been accepted. The next step is the development of effective delivery mechanisms to allow this to take place. The length of time needed to bring about behavioral change and for individuals to progress between stages of literacy appears to be much longer than originally anticipated. It may be necessary to review and adjust proposed timetables for establishing computing literacy across an academic community.

Computing literate campuses will not become a reality until all the groups within the academic community have access to computer literacy programs with a curriculum and a delivery mechanism that meets the needs of their user groups. The development of a computing literacy program for educational administrators is an important step in achieving this goal.